AP Statistics Test
Bivariate Data: Regression Analysis and Two-Way Tables
Instructor's Version

Free Response: 3 questions, 52 points, 30 minutes

1. Is the final course grade in a particular class affected by a student's attendance? The information shown below was calculated based on the final course grades and absences of 63 AP Statistics students (*x* is the number of days absent and *y* is the course grade).

$\bar{x}$ = 3.524 s_x = 2.116 $\bar{y}$ = 83.333 s_y = 6.867 r = -.328

A. Use the information provided to write the equation of the least-squares regression line. Show all calculations. (10 points)

Answer: Slope: $b = r\frac{s_y}{s_x} = -.328\left(\frac{6.867}{2.116}\right) = -1.064$
y-int: $a = \bar{y} - b\bar{x} = 83.333 - (-1.064)(3.524) = 83.333 + 3.750 = 87.083$
LSRL: $\hat{y} = 87.083 - 1.064x$

Scoring notes:
- 8 points for calculations (4 points each)
- 2 points for least-squares regression line

B. Interpret the correlation r = -.328. (4 points)

Answer: There is a weak, negative linear relationship between the number of absences students have and their final grade in the course.

Scoring notes:
- 4 points for giving each component of this part: There is a weak, negative, linear relationship between absences and grade.
- Award partial credit as necessary.

C. Interpret the slope of the least-squares regression line. (4 points)

Answer: For every increase of 1 in the number of absences, there will be, on average, a corresponding decrease of about 1.064 points in the final course grade.

Scoring notes:
- Award all 4 points for the correct answer, but award only 2 points if the student does not use language such as "on average" or "we can expect." Also, award only 2 points if the phrase "a decrease of" is not included.

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D. Interpret the y-intercept of the least-squares regression line. (4 points)

Answer: The LSRL predicts that the final course grade for a student with 0 absences will be about 87.

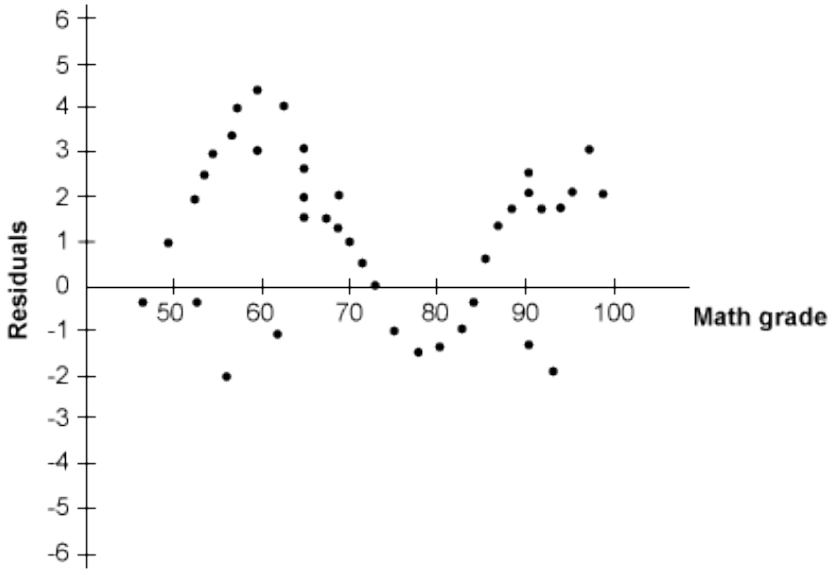
Scoring notes:
- 4 points if student shows the following calculation with interpretation: $\hat{y}$ = 87.083 – 1.064(0) = 87.083 [**VARIABLE LOOKS CUT-AND-PASTED]

E. Calculate r^2 and interpret it. (6 points)

Answer: $r^2 = (-.328)^2 = .108$
About 10.8 percent of the variation in final course grade can be accounted for by the linear relationship with the number of absences.

Scoring notes:
- 2 points for correct calculation
- 4 points for a correct interpretation

2. Shown below is a residual plot that plots the explanatory variable (math grade) against the residuals for the response variable (SAT math score) after a least regression was performed on information from 40 juniors and seniors at Central High School. Based *only* on the residual plot, does a linear model appear to be appropriate for the data? (6 points)



Answer: A linear model would not be appropriate for this data, because the residual plot shows a curved pattern and the majority of the residuals lie above the horizontal axis.

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3. The following two-way table represents the results of a survey in which 5,000 high school students were asked about their plans after graduation.

	Four-year college	Trade or technical school	Enter workforce	Armed services	Other
Male	1,200	600	500	400	250
Female	1,300	300	200	100	150

A. Calculate the marginal distributions for the table and write them below (4 points)

Answer: Row totals are: Male: 2,950 Female 2,050
Column totals are:

Four-year college	2,500
Trade or technical school	900
Workforce	700
Armed services	500
Other	400

B. What percentage of females plans to enter the workforce? (4 points)

Answer: 200/2,050 =.0976 or about 9.8 percent

C. What percentage of students plans to attend a trade or technical school? (4 points)

Answer: (600 + 300)/ 5,000 = 900/5,000 =.18 or 18 percent

D. Explain how the two-way table shown could contradict this statement: "Half of all high school students plan to attend a four-year college." (6 points)

Answer: The student should note that this is an example of Simpson's Paradox. When we group the students together, there are 2,500 out of 5,000 (or exactly 50 percent) who plan to go to a four-year college. However, when we look at the table that is broken up by gender, 1,200 out of 2,950 males (or 40.7 percent) plan to go to a four-year college, while 1,300 out of 2,050 females (or 63.4 percent) plan to go to a four-year college. If the student does not cite this as an example of Simpson's Paradox, award a maximum of 4 points.

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